



## John T. Anderson Engineering Note

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**Project:** CFT Axial  
**Doc. No:** a980818a

**Subject:** Mapping of fibers on backplanes between left hand and right hand CFT boards using by-6 multiplexing as opposed to by-4 multiplexing

This note presents a variation on the pin multiplexing scheme given in note a980813a. See that note for comparison.

Each cassette in the CFT system has two boards, the *left-hand board* (LHB) and the *right-hand board* (RHB). Each board 'sees' one sector of fibers in the detector. In order to provide mapping of tracks across sector boundaries, the LHB and the RHB have to share data with each other, and also with their neighbors on either side. The terms 'previous' and 'next' are used to indicate these neighbor boards.

Within a left/right pair, the LHB is the 'previous' board to the RHB, which makes the RHB the 'next' board to the LHB. Within a backplane, the LHB of the adjacent left/right pair is the 'next' board to the RHB of the current left/right pair. This is shown graphically in Figure 1. The adjacent backplane may not be located in the physically adjacent crate; adjacency of backplanes is determined by the cables which interconnect them.

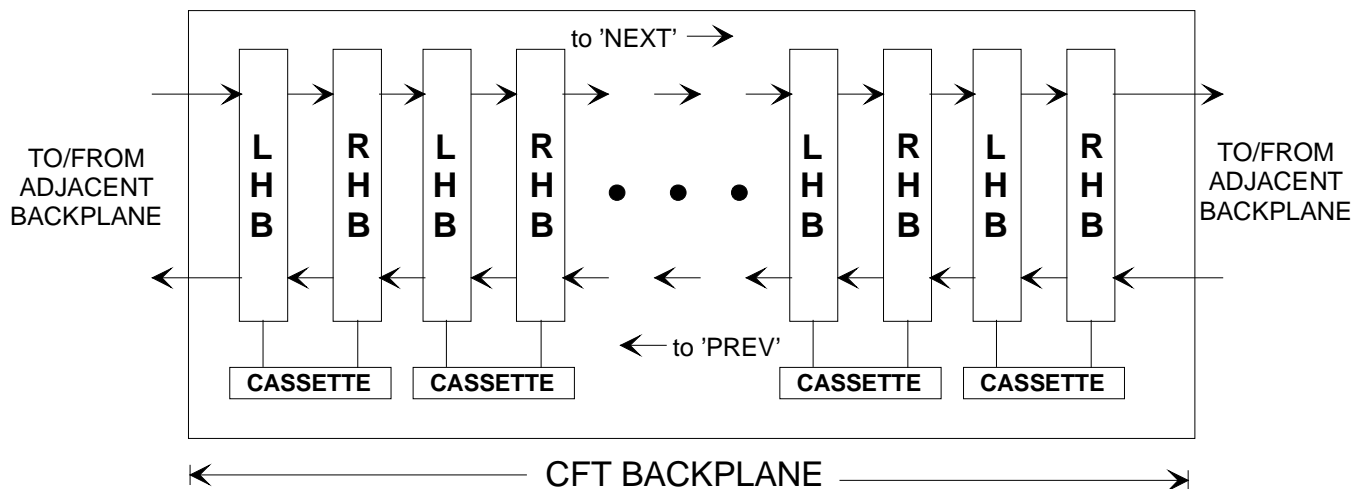


Figure 1

In the CFT documentation so far fibers are listed as being on 'inner' or 'outer' singlet layers, and each sector is numbered individually. This causes problems when thinking about the backplanes because it causes duplicate signal names within a LHB/RHB pair; for instance, both boards within a pair are connected to a  $A_i[0]$  fiber. To eliminate duplicitous signal names, an arbitrary fiber number is assigned for each fiber in a *pair* of sectors. This allows for signal names to be unique within a pair of boards. A picture of a sector pair with all fibers numbered is shown in Figure 2.

A heavy black line shows the breakout of connections from the sector pair into the board pair. Fibers to the left of the heavy black line are physically connected to the LHB, and fibers to the right are connected to the RHB. Each layer of the detector (A-H) is assigned numbers from 0 on up across the pair of sectors associated with a left/right pair of boards. This allows each cassette to be viewed independently of any other cassette and independent of detector angle. A left/right board pair receives all the fibers of a sector pair and transfers them to the logically previous and next boards in the detector. In order to

save pins, a set of fibers are transferred each 53MHz clock tick within the 132 nsec cycle. Six clock cycles are used to transfer all fibers between all boards.

The remainder of this document details which fibers are transferred on which clock tick, and how many pins of the backplane connection are required to accomplish the transfer.

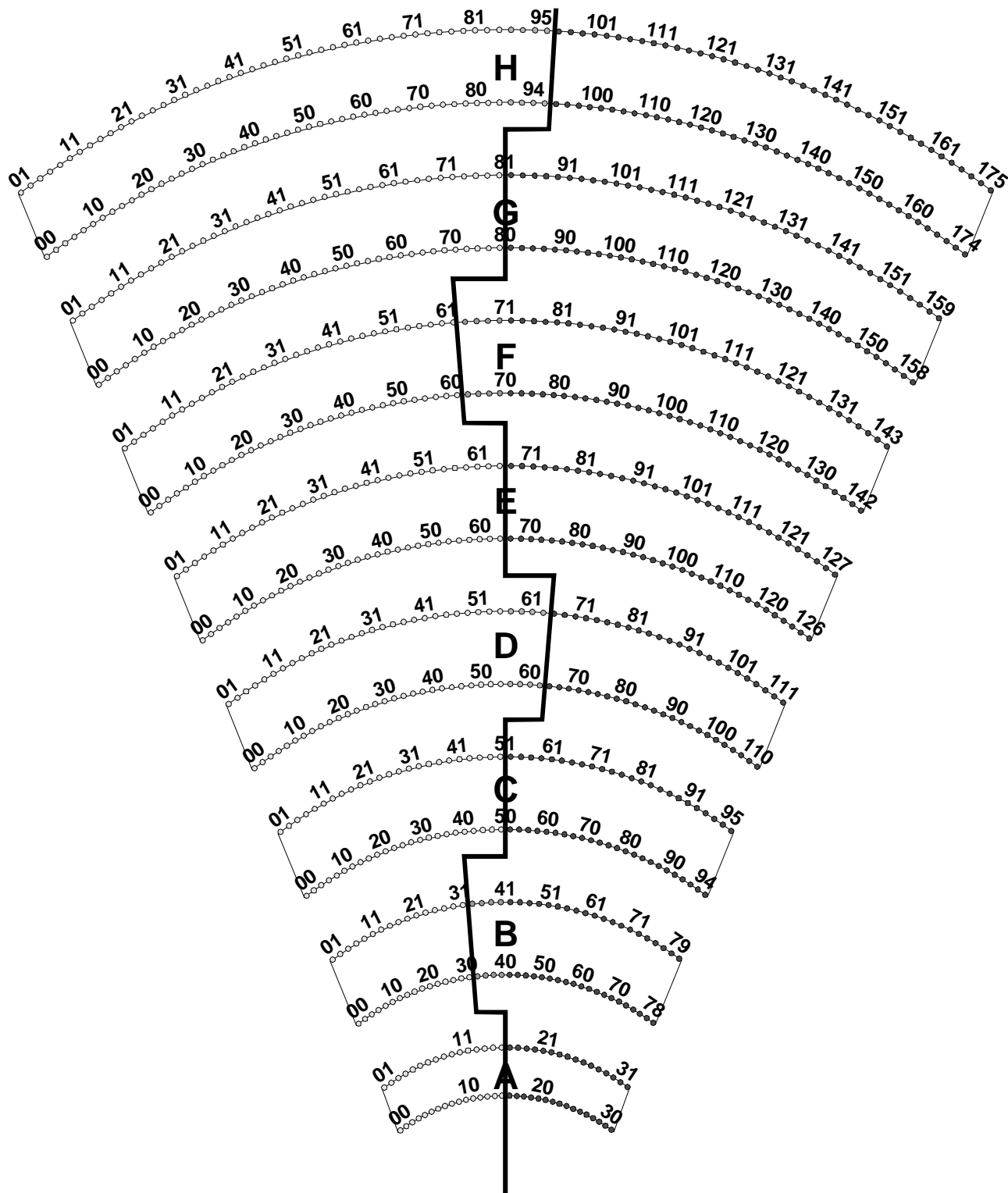


Figure 2

## A Layer

There are 32 fibers presented to each board from the A layer. On the first clock tick all the discriminator outputs from the SIFTs on both boards are captured in Latch logic. On the six successive clock ticks the fibers are transmitted between boards. The clock used throughout is the 53 MHz main clock.

- The LHB of a pair receives fibers A0-A31. Of these, fibers A0-A3 are sent to the previous neighbor, fibers A28-A31 are sent to the RHB, and fibers A4-A27 are sent to both.
- The RHB of a pair receives fibers A32- A63. Fibers A32-A36 are sent to the LHB, fibers A60-A63 to the next neighbor and fibers A36-A59 are sent to both.

Clock Tick	1	2	3	4	5	6	7	Pins required on a given board
LHB sends to previous neighbor	Latch data	A0	A1	A2	A3	N/A	N/A	1 out on LHB of pair 1 in on RHB in previous sector
LHB sends to RHB	Latch data	A28	A29	A30	A31	N/A	N/A	1 out on LHB of pair 1 in on RHB of pair
LHB sends to both previous neighbor and RHB	Latch data	A4,A5, A6,A7	A8,A9, A10,A11	A12,A13, A14,A15	A16,A17, A18,A19,	A20,A21, A22,A23	A24,A25, A26,A27	4 out on LHB of pair 4 in on RHB in previous sector 4 in on RHB of pair
RHB sends to LHB	Latch data	A32	A33	A34	A35	N/A	N/A	1 out on RHB of pair 1 in on LHB of pair
RHB sends to next neighbor	Latch data	A60	A61	A62	A63	N/A	N/A	1 out on RHB of pair 1 in on LHB of next sector
RHB sends to both LHB and next neighbor	Latch data	A36,A37, A38,A39	A40,A41, A42,A43	A44,A45, A46,A47	A48,A49, A50,A51	A52,A53, A54,A55,	A56,A57, A58,A59	4 out on RHB of pair 4 in on LHB of pair 4 in on LHB in next sector
								Total: Any LHB: 6 outputs, 10 inputs Any RHB: 6 outputs, 10 inputs

**Table 1**

Since the A layer is routed equally between boards, the number of I/O pins on the LHB and RHB are identical.

## B Layer

The B layer is a little more complicated than the A layer. Not only are there more fibers, but they aren't evenly split between the LHB and the RHB. A few extra fibers enter the RHB and have to be transferred from the RHB to the LHB. This is caused by fiber bundling and connector pinout limitations. These fibers can be viewed as part of the previous/next data passing but are counted out separately to insure correct pin counts.

- The LHB directly receives fibers B0-B31. Fibers B0-B11 are sent to the previous neighbor, fibers B28-B31 are sent to the RHB, and fibers B12-B27 are sent to both.
- The RHB receives fibers B32-B79. Fibers B32-B39 are sent to the LHB to make up for the bundling mismatches. In addition, fibers B40-B51 are sent to the LHB. Fibers B68-B79 are sent to the next neighbor and fibers B52-B67 to both.

Clock Tick	1	2	3	4	5	6	7	Pins required on a given board
LHB sends to previous neighbor	Latch data	B0,B1	B2,B3	B4,B5	B6,B7	B8,B9,	B10,B11	2 out on LHB of pair 2 in on RHB of previous sector
LHB sends to RHB	Latch data	B28	B29	B30	B31	N/A	N/A	1 out on LHB of pair 1 in on RHB of pair
LHB sends to both previous neighbor and RHB	Latch data	B12,B13, B14	B15,B16, B17	B18,B19, B20,	B21,B22, B23	B24,B25, B26,	B27, N/A, N/A	3 out on LHB of pair 3 in on RHB of previous sector 3 in on RHB of pair
Private RHB to LHB transfer	Latch data	B32, B33	B34,B35	B36,B37	B38,B39	N/A	N/A	2 out on RHB of pair 2 in on LHB of pair
RHB sends to LHB	Latch data	B40,B41	B42,B43	B44,B45	B46,B47,	B48,B49,	B50, B51	2 out on RHB of pair 2 in on LHB of pair
RHB sends to next neighbor	Latch data	B68,B69	B70,B71	B72,B73	B74,B75	B76,B77	B78, B79	2 out on RHB of pair 2 in on LHB of next sector
RHB sends to both LHB and next neighbor	Latch data	B52,B53, B54	B55,B56, B57	B58,B59, B60	B61,B62, B63	B64, B65, B66	B67, N/A, N/A	3 out on RHB of pair 3 in on LHB of pair 3 in on LHB of next sector
								Totals: LHB: 12 in, 6 out RHB: 9 in, 9 out

**Table 2**

Because of the mismatch in the number of fibers presented to the RHB and LHB, the number of inputs vs. outputs is different between the two board types. However, the total amount of I/O is the same for the two board types.

## C layer

The C layer, like the A layer, is evenly split between the two boards in a left/right pair. The LHB; the RHB sees. According to Manuel's notes, the two boards must pass data as follows:

- The LHB receives fibers C0-C47. It sends fibers C0-C19 to the previous neighbor, fibers C28-C47 to the RHB, and fibers C20-C27 to both.
- The RHB receives fibers C48-C95. It sends fibers C48-C67 to the LHB, fibers C76-C95 to the next neighbor and fibers C68-C75 to both.

Clock Tick	1	2	3	4	5	6	7	Pins required on a given board
LHB sends to previous neighbor	Latch data	C0,C1, C2,C3	C4,C5, C6,C7	C8,C9, C10,C11	C12,C13, C14,C15	C16, C17, C18, C19	N/A,N/A, N/A,N/A	4 out on LHB of pair 4 in on RHB of previous sector
LHB sends to RHB	Latch data	C28,C29, C30,C31,	C32,C33, C34,C35	C36,C37, C38,C39	C40,C41, C42,C43	C44,C45, C46,C47	N/A,N/A, N/A,N/A	4 out on LHB of pair 4 in on RHB of pair
LHB sends to both previous neighbor and RHB	Latch data	C20,C21	C22,C23	C24,C25	C26,C27	N/A	N/A	2 out on LHB of pair 2 in on RHB of pair 2 in on RHB of previous sector
RHB sends to LHB	Latch data	C48,C49, C50,C51	C52,C53, C54,C55	C56,C57, C58,C59	C60,C61, C62,C63	C64,C65, C66,C67	N/A,N/A, N/A,N/A	4 out on RHB of pair 4 in on LHB of pair
RHB sends to next neighbor	Latch data	C76,C77, C78,C79,	C80,C81, C82,C83	C64,C85, C86,C87	C88,C89, C90,C91	C92,C93, C94,C95	N/A,N/A, N/A,N/A	4 out on RHB of pair 4 in on LHB of next sector
RHB sends to both LHB and next neighbor	Latch data	C68,C69	C70,C71	C72,C73	C74,C75	N/A	N/A	2 out on RHB of pair 2 in on LHB of pair 2 in on LHB of next sector
								Totals: LHB: 12 inputs, 10 outputs. RHB: 12 inputs, 10 outputs.

**Table 3**

Again, an evenly split sector pair results in matching I/O counts for the two board types.

## D layer

In the D layer, as in the B layer, eight fibers received by one board are passed to the other board in the left/right pair. The D layer passing requires that the LHB pass eight fibers (D56-D63) to the RHB. The fiber passing for previous/next architecture is as follows:

- The LHB receives fibers D00-D63 and sends fibers D00-D23 to the previous neighbor and fibers D32-D55 to the RHB. No fibers go to both.
- The RHB directly receives fibers D64-D111. Fibers D64-D79 are sent to the LHB, and fibers D88-D111 are sent to the next neighbor. No fibers go to both.

Clock Tick	1	2	3	4	5	6	7	Pins required on a given board
LHB sends to previous neighbor	Latch data	D0,D1,D2,D3	D4,D5,D6,D7	D8,D9,D10,D11	D12,D13,D14,D15	D16,D17,D18,D19	D20,D21,D22,D23	4 out on LHB of pair 4 in on RHB of previous sector
LHB sends to RHB	Latch data	D32,D33,D34,D35	D36,D37,D38,D39	D40,D41,D42,D43	D44,D45,D46,D47	D48,D49,D50,D51	D52,D53,D54,D55	4 out on LHB of pair 4 in on RHB of pair
Private LHB to RHB transfer	Latch data	D56,D57	D58,D59	D60,D61	D62,D63	N/A,N/A	N/A,N/A	2 out on LHB of pair 2 in on RHB of pair
RHB sends to LHB	Latch data	D64,D65,D66	D67,D68,D69	D70,D71,D72	D73,D74,D75	D76,D77,D78	D79,N/A,N/A	3 out on RHB of pair 3 in on LHB of pair
RHB sends to next neighbor	Latch data	D88,D89,D90,D91	D92,D93,D94,D95	D96,D97,D98,D99	D100,D101,D102,D103	D104,D105,D106,D107	D108,D109,D110,D111	4 out on RHB of pair 4 in on LHB of next sector
								Totals: LHB: 10 outputs, 7 inputs RHB: 7 outputs, 10 inputs

**Table 4**

## E layer

The E layer is symmetric like the A and C layers. 128 fibers are split evenly between the two boards in a left/right pair.

- The LHB receives fibers E00-E63. Fibers E00-E31 are sent to the previous neighbor, E32-E63 to the RHB, and none to both.
- The RHB receives fibers E64-E127. Fibers E64-E95 are sent to the LHB, E96-E127 to the next neighbor, and none to both.

Clock Tick	1	2	3	4	5	6	7	Pins required on a given board
LHB sends to previous neighbor	Latch data	E00,E01, E02,E03, E04,E05	E06,E07 E08,E09, E10,E11	E12,E13, E14,E15, E16,E17	E18,E19, E20,E21, E22,E23	E24,E25, E26,E27, E28,E29	E30,E31, N/A,N/A, N/A,N/A	6 out on LHB 6 in on RHB of previous sector
LHB sends to RHB	Latch data	E32,E33, E34,E35, E36,E37	E38,E39, E40,E41, E42,E43	E44,E45, E46,E47, E48,E49	E50,E51, E52,E53, E54,E55	E56,E57, E58,E59, E60,E61	E62,E63, N/A,N/A, N/A,N/A	6 out on LHB of pair 6 in on RHB of pair
RHB sends to LHB	Latch data	E64,E65, E66,E67, E68,E69	E70,E71, E72,E73, E74,E75	E76,E77, E78,E79, E80,E81	E82,E83, E84,E85, E86,E87	E88,E89, E90,E91, E92,E93	E94,E95, N/A,N/A, N/A,N/A	6 out on RHB of pair 6 in on LHB of pair
RHB sends to next neighbor	Latch data	E96,E97, E98,E99, E100,E101	E102,E103, E104,E105, E106,E107	E108,E109, E110,E111, E112,E113	E114,E115, E116,E117, E118,E119	E120,E121, E122,E123, E124,E125	E126,E127, N/A,N/A, N/A,N/A	6 out on RHB of pair 6 in on LHB of next sector
								Totals: 12 inputs & 12 outputs (both board types)

**Table 5**

## F layer

In the F layer, like the B layer, eight fibers are received by the RHB that really belong to the LHB.

- The LHB receives fibers F00-F63. Fibers F00-F23 are sent to the previous neighbor, fibers F48-F63 to the RHB and fibers F24-F47 to both.
- The RHB receives fibers F64-F143. Fibers F64-F71 are sent via private bus to the LHB to compensate for bundling mismatches. Fibers F72-F95 are also sent to the LHB. fibers F120-F143 are sent to the next neighbor and fibers F96-F119 are sent to both the LHB and the next neighbor.

Clock Tick	1	2	3	4	5	6	7	Pins required on a given board
LHB sends to previous neighbor	Latch data	F00,F01, F02,F03	F04,F05, F06,F07	F08,F09, F10,F11	F12,F13, F14,F15	F16,F17, F18,F19	F20,F21, F22,F23	4 out on LHB of pair 4 in on RHB of previous sector
LHB sends to RHB	Latch data	F48,F49, F50	F51,F52, F53	F54,F55, F56	F57,F58, F59	F60,F61, F62	F63,N/A, N/A	3 out on LHB of pair 3 in on RHB of pair
LHB sends to both previous neighbor and RHB	Latch data	F24,F25, F26,F27	F28,F29, F30,F31	F32,F33, F34,F35	F36,F37, F38,F39	F40,F41, F42,F43	F44,F45, F46,F47	4 out on LHB of pair 4 in on RHB of pair 4 in on RHB of previous sector
Private RHB to LHB transfer	Latch data	F64,F65	F66,F67	F68,F69	F70,F71	N/A,N/A	N/A,N/A	2 outputs on RHB 2 inputs on LHB
RHB sends to LHB	Latch data	F72,F73, F74,F75	F76,F77, F78,F79	F80,F81, F82,F83	F84,F85, F86,F87	F88,F89, F90,F91	F92,F93, F94,F95	4 out on RHB 4 in on LHB
RHB sends to next neighbor	Latch data	F120,F121, F122,F123	F124,F125, F126,F127	F128,F129, F130, F131	F132,F133, F134,F135	F136,F137, F138,F139	F140,F141, F142,F143	4 out on RHB 4 in on LHB of next sector
RHB sends to both LHB and next neighbor	Latch data	F96,F97, F98,F99	F100,F101, F102,F103	F104,F105, F106,F107	F108,F109, F110,F111	F112,F113, F114,F115	F116,F117, F118,F119	4 out on RHB 4 in on LHB 4 in on LHB of next sector
								Totals: LHB: 18 inputs, 11 outputs. RHB: 15 inputs, 14 outputs.

**Table 6**



## G layer

The G layer is again symmetric, with a total of 160 input fibers per board pair.

- The LHB receives fibers G00-G79. Fibers G00-G19 are sent to the previous neighbor, fibers G20-G59 to both the previous neighbor and the RHB, fibers G60-G79 to the RHB.
- The RHB receives fibers G80-G159. Fibers G80-G99 are sent to the LHB, fibers G100-G139 to both the LHB and the next neighbor, fibers G140-G159 to the next neighbor.

Clock Tick	1	2	3	4	5	6	7	Pins required on a given board
LHB sends to previous neighbor	Latch data	G00,G01, G02,G03	G04,G05, G06,G07	G08,G09, G10,G11	G12,G13, G14,G15	G16,G17, G18,G19	N/A,N/A, N/A,N/A	4 out on LHB of pair 4 in on RHB of previous sector
LHB sends to RHB	Latch data	G60,G61, G62,G63	G64,G65, G66,G67	G68,G69, G70,G71	G72,G73, G74,G75	G76,G77, G78,G79	N/A,N/A, N/A,N/A	4 out on LHB of pair 4 in on RHB of pair
LHB sends to both previous neighbor and RHB	Latch data	G20,G21, G22,G23, G24,G25, G26	G27,G28, G29,G30, G31,G32, G33	G34,G35, G36,G37, G38,G39, G40	G41,G42, G43,G44, G45,G46, G47	G48,G49, G50,G51, G52,G53, G54	G55,G56, G57,G58, G59	7 out on LHB of pair 7 in on RHB of pair 7 in on RHB of previous sector
RHB sends to LHB	Latch data	G80,G81, G82,G83	G84,G85, G86,G87	G88,G89, G90,G91	G92,G93, G94,G95	G96,G97, G98,G99	N/A,N/A, N/A,N/A	4 out on RHB of pair 4 in on LHB of pair
RHB sends to next neighbor	Latch data	G140,G141, G142,G143	G144,G145, G146,G147	G148,G149, G150,G151	G152,G153, G154,G155	G156,G157, G158,G159	N/A,N/A, N/A,N/A	4 out on RHB of pair 4 in on LHB of next sector
RHB sends to both next neighbor and LHB		G100,G101, G102,G103, G104,G105, G106	G107,G108, G109,G110, G111,G112, G113	G114,G115, G116,G117, G118,G119, G120	G121,G122, G123,G124, G125,G126, G127	G128,G129, G130,G131, G132,G133, G134	G135,G136, G137,G138, G139	7 out on RHB of pair 7 in on LHB of pair 7 in on LHB of next sector
								Totals: 22 inputs & 15 outputs (both types)

**Table 7**

## H layer

The outermost, or H layer, is asymmetric and contains a total of 176 fibers. Eight fibers are received by the LHB and sent via private bus to the RHB.

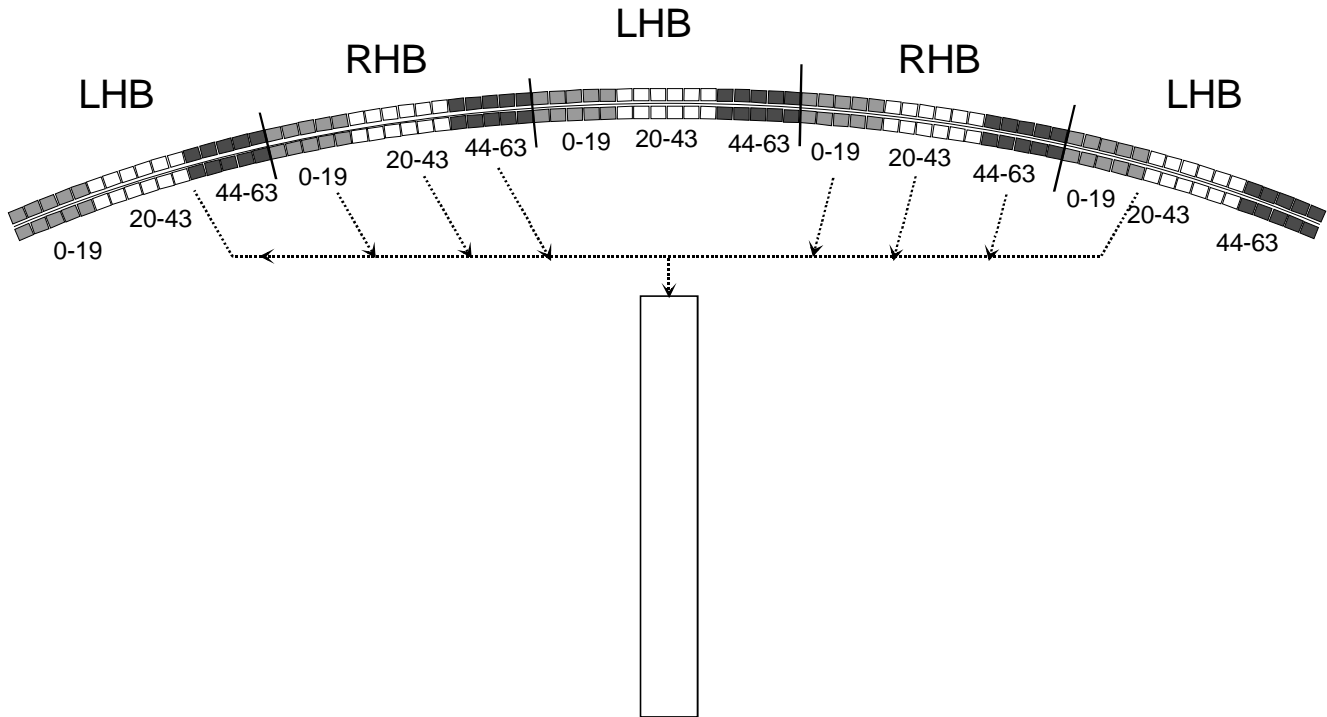
- The LHB receives fibers H00-H95. Fibers H00-H15 are sent to the previous neighbor. Fibers H16-H71 are sent to both the previous neighbor and to the RHB. Fibers H72-H95 are sent to the RHB.
- The RHB directly receives fibers H96-H176. Fibers H96-H103 are sent to the LHB. Fibers H104-H159 are sent to both the LHB and the next neighbor. Fibers H160-H179 are sent to the next neighbor.

Clock Tick	1	2	3	4	5	6	7	Pins required on a given board
Private bus, LHB to RHB	Latch data	H72,H73	H74,H75	H76,H77	H78,H79	N/A,N/A	N/A,N/A	2 out on LHB of pair 2 in on RHB of pair
LHB sends to previous neighbor	Latch data	H00,H01, H02	H03,H04, H05	H06,H07, H08	H09,H10, H11	H12,H13, H14	H15,N/A, N/A	3 out on LHB of pair 3 in on RHB of previous sector
LHB sends to RHB	Latch data	H80,H81, H82	H83,H84, H85	H86,H87, H88	H89,H90, H91	H92,H93, H94	H95,N/A, N/A	3 out on LHB of pair 3 in on RHB of pair
LHB sends to both previous neighbor and RHB	Latch data	H16,H17, H18,H19, H20,H21, H22,H23, H24,H25	H26,H27, H28,H29, H30,H31, H32,H33, H34,H35	H36,H37, H38,H39, H40,H41, H42,H43, H44,H45	H46,H47, H48,H49, H50,H51, H52,H53, H54,H55	H56,H57, H58,H59, H60,H61, H62,H63, H64,H65	H66,H67, H68,H69, H70,H71, N/A,N/A, N/A,N/A	10 out on LHB of pair 10 in on RHB of pair 10 in on RHB of previous sector
RHB sends to LHB	Latch data	H96,H97	H98,H99	H100,H101	H102,H103	N/A,N/A	N/A,N/A	2 out on RHB of pair 2 in on LHB of pair
RHB sends to next neighbor	Latch data	H160,H161, H162	H163,H164, H165	H166,H167 H168	H169,H170, H171	H172,H173, H174	H175,N/A, N/A	3 out on RHB of pair 3 in on LHB of next sector
RHB sends to both next neighbor and LHB	Latch data	H104,H105, H106,H107, H108,H109, H110,H111, H112,H113	H114,H115, H116,H117, H118,H119, H120,H121, H122,H123	H124,H125, H126,H127, H128,H129, H130,H131, H132,H133	H134,H135, H136,H137, H138,H139, H140,H141, H142,H143	H144,H145, H146,H147, H148,H149, H150,H151, H152,H153	H154,H155, H156,H157, H158,H159, N/A,N/A, N/A,N/A	10 out on RHB of pair 10 in on LHB of pair 10 in on LHB of next sector
								Totals: LHB: 25 inputs, 18 outputs. RHB: 28 inputs, 15 outputs.

**Table 8**

## Preshower signals

Each sector of the detector has 32 Preshower strips in addition to all the fibers. To further complicate the situation, each of the 32 Preshower strips seen by an LHB or RHB is sampled twice – against two different thresholds. Thus, 64 bits of preshower information is actually transmitted by each board. The preshower geometry is such that each CFT board sees, in addition to it's area, all the preshower information of both neighbor boards plus some data from the next board past the neighbor. This geometry is shown in Figure 3.



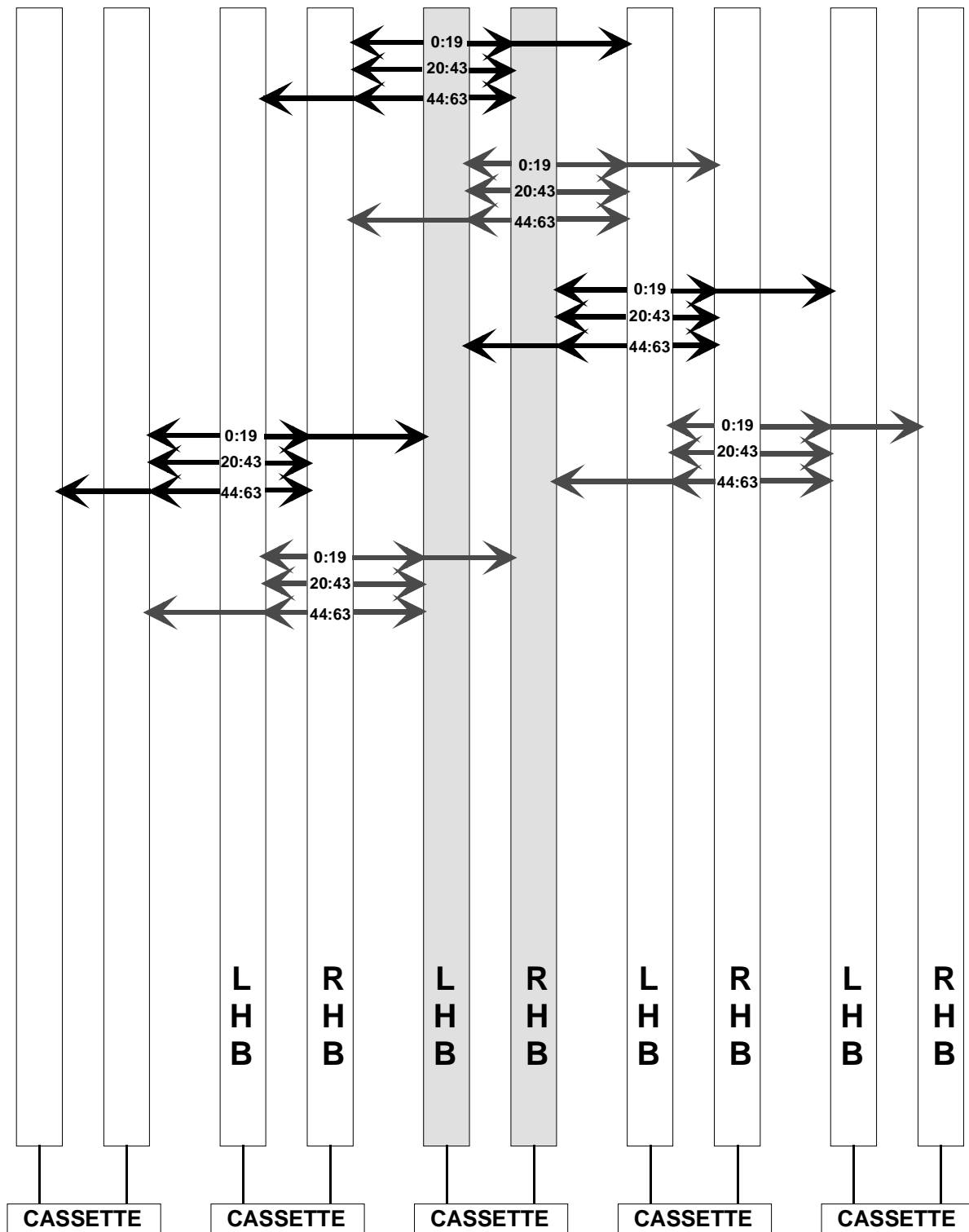
**Figure 3**

This interconnection scheme requires a large number of pins per board. Table 9 shows the pin requirements for the LHB and the RHB.

Clock Tick	1	2	3	4	5	6	7	Pins required on a given board
LHB sends to RHB of pair, RHB in previous sector and the LHB previous to that RHB	Latch data	PS0,PS1, PS2,PS3	PS4,PS5,PS6,PS7	PS8,PS9, PS10,PS11	PS12,PS13, PS14,PS15	PS16, PS17, PS18, PS19	N/A,N/A, N/A,N/A	4 out on LHB of pair 4 in on RHB of pair 4 in on RHB of previous sector 4 in on LHB of previous sector
LHB sends to RHB in previous sector and RHB of pair	Latch data	PS20,PS21, PS22,PS23	PS24,PS25, PS26,PS27	PS28,PS29, PS30,PS31	PS32,PS33, PS34,PS35	PS36,PS37, PS38,PS39	PS40,PS41, PS42,PS43	4 out on LHB of pair 4 in on RHB of pair 4 in on RHB of previous sector
LHB sends to RHB of previous sector, RHB of pair and to LHB in next sector	Latch data	PS44,PS45, PS46,PS47	PS48,PS49, PS50,PS51,	PS52,PS53, PS54,PS55,	PS56,PS57, PS58,PS59	PS60,PS61, PS62,PS63	N/A,N/A, N/A,N/A	4 out on LHB of pair 4 in on RHB of previous sector 4 in on RHB of pair 4 in on LHB of next sector
RHB sends to LHB of pair, RHB in previous sector and the LHB in next sector	Latch data	PS0,PS1, PS2,PS3	PS4,PS5, PS6,PS7	PS8,PS9, PS10,PS11	PS12,PS13, PS14,PS15	PS16,PS17, PS18,PS19	N/A,N/A, N/A,N/A	4 out on RHB of pair 4 in on LHB of pair 4 in on RHB of previous sector 4 in on LHB of next sector
RHB sends to LHB in next sector and LHB of pair	Latch data	PS20,PS21, PS22,PS23	PS24,PS25, PS26,PS27	PS28,PS29, PS30,PS31	PS32,PS33, PS34,PS35	PS36,PS37, PS38,PS39	PS40,PS41, PS42,PS43	4 out on RHB of pair 4 in on LHB of pair 4 in on LHB of next sector
RHB sends to LHB of pair, LHB of next sector and RHB of next sector	Latch data	PS44,PS45, PS46,PS47	PS48,PS49, PS50,PS51	PS52,PS53, PS54,PS55	PS56,PS57, PS58,PS59	PS60,PS61, PS62,PS63	N/A,N/A, N/A,N/A	4 out on RHB of pair 4 in on LHB of pair 4 in on LHB of next sector 4 in on RHB of next sector
								Totals: 12 output and 32 input pins, both board types.

**Table 9**

A more 'backplane' view of the preshower data passing is given in Figure 4.



An LHB has 64 output signals and receives a total of 168 signals (16 & 42 pins)

An RHB has 64 output signals and receives a total of 168 signals (16 & 42 pins)

Figure 4

## Backplane Summation

This last table summarizes how many inputs and outputs each type of board – LHB and RHB – requires. For comparison, the totals from the multiplex-by-4 are shown in addition to the new totals for the multiplex-by-six option.

Layer	LHB, multiplex by four (old way)		LHB, multiplex by six			RHB, multiplex by four (old way)		RHB, multiplex by six	
	Inputs	Outputs	Inputs	Outputs		Inputs	Outputs	Inputs	Outputs
A	14	8	10	6		14	8	10	6
B	16	8	12	6		12	12	9	9
C	14	12	12	10		14	12	12	10
D	10	14	7	10		14	10	10	7
E	16	16	12	12		16	16	12	12
F	26	16	18	11		22	20	15	14
G	30	20	22	15		30	20	22	15
H	34	24	25	18		38	20	28	15
Preshower	42	16	32	12		42	16	32	12
<b>TOTALS</b>	202	134	150	100		202	134	150	100
<b>GRAND TOTAL</b>	336		250			336		250	

**Table 10**

Changing from a by-four to a by-six multiplexing scheme saves 86 pins in both the right-hand and left-hand boards, or 25.5%. A consequence of changing to a by-six scheme is that on certain clock cycles not all pins will have valid data; the PLD designs in the CFT boards will have to accommodate that.